eXtremeRAID™ Installation Guide

eXtremeRAID 1100
PCI to Ultra2 SCSI
RAID Controller

P/N: 775013-01

eXtremeRAID™
DAC1164P™
PCI to Ultra2 SCSI
RAID Controller
Installation Guide

775013-01

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About This Manual

This installation guide covers hardware set-up and configuration procedures necessary for the installation of a Mylex DAC1164P PCI to Ultra2 SCSI RAID controller.

Chapter 1 describes the controller, standard package contents, and user-supplied items necessary for installation.

Chapter 2 describes the steps to be performed prior to controller installation.

Chapter 3 describes the physical installation of the DAC1164P controller.

Chapter 4 describes controller start-up and the BIOS resident utilities.

Appendix A describes the memory and battery backup module.

Appendix B provides hardware and environmental specifications.

Appendix C describes error messages and problem correction.

Appendix D describes the PCI Hot Plug feature.

Appendix E provides enclosure management information.

Appendix F provides regulatory agency information.

Conventions

Throughout the manual, the following conventions are used to describe user interaction with the product:

`prompt` This style of type indicates screen display messages

Enter Press the key labeled “Enter” (or “Delete”, etc.)

Note

Supplementary information that can have an effect on system performance

Caution

Notification that a proscribed action has the *potential* to adversely affect equipment operation, system performance, or data integrity

WARNING

Notification that a proscribed action will *definitely* result in equipment damage, data loss, or personal injury

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Glossary

Chapter 1
Introduction

This chapter describes:

- **The eXtremeRAID™ controller**
- **Standard package contents**
- **User supplied items**

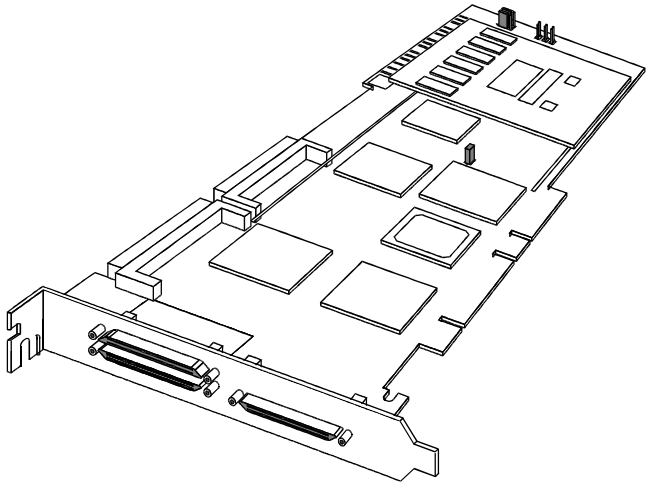


Figure 1-1. DAC1164P Disk Array Controller

Product Description

The Mylex eXtremeRAID 1100 (DAC1164P™) controller is a PCI to Ultra2 SCSI RAID controller with 64-bit PCI capability. With up to three Ultra2 SCSI channels, and a cache memory battery backup, this controller provides the speed and functionality required by high demand server platforms.

Controller Features

Features of the DAC1164P controller include:

- Up to three Ultra2 SCSI channels that support RAID levels 0, 1, 3, 5, 0+1, 10, 30, and 50.
- Low-Voltage Differential (LVD) Wide Ultra2 SCSI (Fast 40). Controller also supports SCSI 1, 2, or 3, single-ended.
- High performance RISC processor and 16MB, 32MB, or 64MB SDRAM cache (with parity) on a full-length, 64-bit PCI version 2.1 standard card.
- Memory module (DMM1100) with memory, battery backup, and circuitry for monitoring the battery condition.
- 1MB, 8-bit flash EEPROM for BIOS and code.
- Built-in configuration utilities (in BIOS).
- Supports controller redundancy using a shared SCSI bus in a clustering configuration.
- PCI Hotplug capability allows the DAC1164P to be swapped with a replacement without powering down the system.

> ⚠ ***Caution***
>
> Be sure the motherboard you are using supports PCI Hotplug before attempting to use this feature, or serious damage to the controller and/or the motherboard could result.

Operating System Support

MS-DOS 5.x, 6.x, and above are supported using drivers that reside in the eXtremeRAID BIOS. Many other popular operating systems are supported using software drivers in the Disk Array Controller Software Kit that is included with the DAC1164P controller (see the *Disk Array Controller Software Kit Installation Guide and User Manual* – P/N 771929)

Standard Package Contents

The following items are supplied with the standard shipping package:

Hardware

- DAC1164P Disk Array Controller with documentation on CD-ROM
- DMM1100 Memory Module with battery backup – pre-installed

Software

- RAID EzAssist disk array controller configuration utility with documentation on CD-ROM
- Software Driver Kit with documentation on CD-ROM
- Global Array Manager (GAM) with documentation on CD-ROM

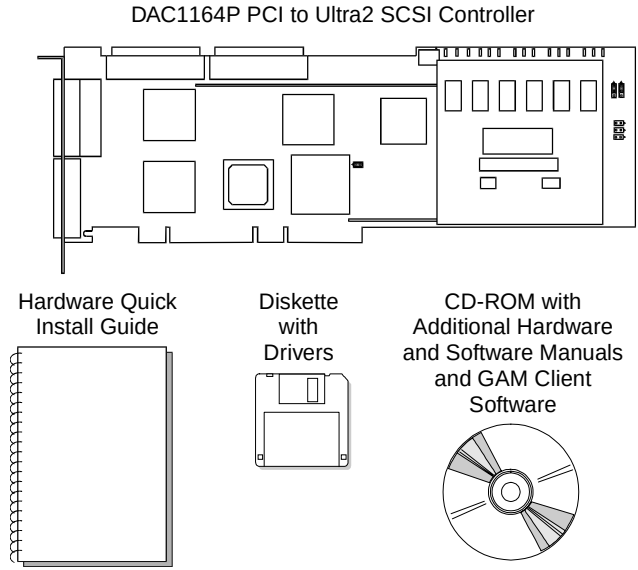

DAC1164P PCI to Ultra2 SCSI Controller
Hardware Quick Install Guide
Diskette with Drivers
CD-ROM with Additional Hardware and Software Manuals and GAM Client Software

Figure 1-2. Standard Package Contents

User-supplied Items

The following user-supplied items are required to perform this installation:

- IBM-PC™ compatible host system with PCI slot (PCI 2.1 compliant)
- Network operating system software (as required)
- SCSI cables to connect the controller and disk arrays
- Static grounding strap or electrostatic discharge (ESD) safe work area
- Disk array enclosure (or equivalent) with SCSI disk drives

Chapter 2
Preinstallation Planning

This chapter describes:

- **SCSI termination**
- **SCSI cabling**
- **SCSI drive preparation**
- **Limitations on mixing various SCSI drive types**

Mylex disk array controllers are designed to work in a variety of SCSI RAID application environments. Certain configuration steps need to be performed prior to installing the controller into a RAID environment.

SCSI Termination

Each end of a SCSI bus must be terminated to maintain proper voltage levels for SCSI control and data signals. The device used for this purpose is called a terminator, and it can be built into a controller, a SCSI peripheral device, or it can be a plug placed on the connector at the very end of a SCSI bus.

The DAC1164P controller is equipped with automatic SCSI termination circuitry. If the controller is at the end of a SCSI bus, it automatically enables on-board termination. The controller can also detect whether single-ended (SE) or low-voltage differential (LVD) termination is required, and can set the on-board termination type as needed.

If all the SCSI devices on a channel are connected either to an internal connector of a channel, or to an external connector of a channel, the end of the SCSI bus farthest from the DAC1164P controller must have a terminator installed. In this case, the controller automatically *enables* on-board termination. See Figure 2-1 for examples of internal or external drive configurations.

If some SCSI devices are connected to the internal connector of a channel, and some are connected to the external connector of the same channel, the two ends of the SCSI bus farthest from the controller must each be terminated. In this case, the DAC1164P controller automatically *disables* on-board termination. See Figure 2-1 for an example of an internal – external drive configuration.

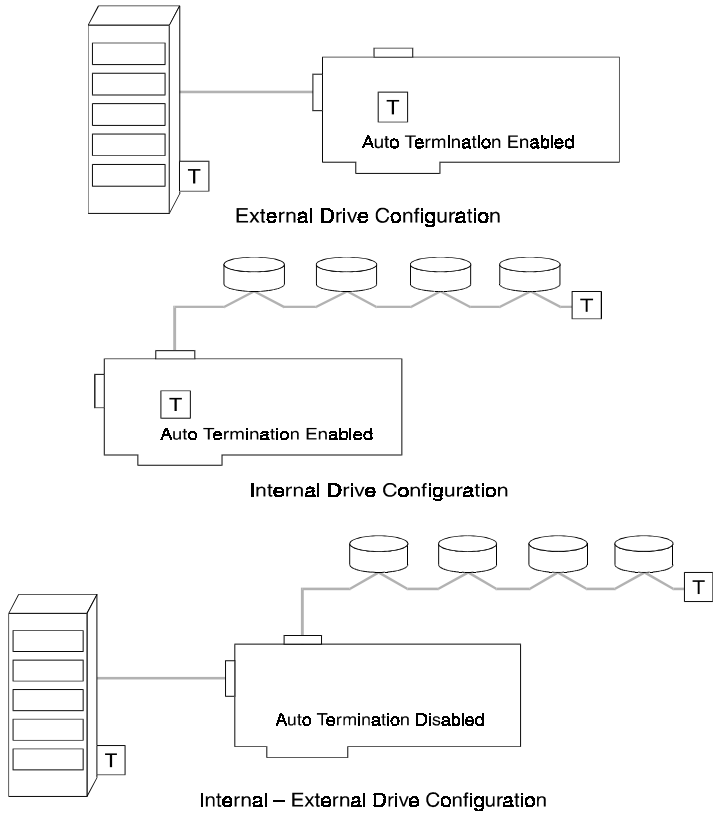


Figure 2-1. DAC1164P Termination Examples

Note

When connecting SCSI devices, it is better to terminate the ends of the SCSI bus itself than it is to terminate the end devices on the bus. This allows hot swap devices to be added or removed from the SCSI bus without affecting termination.

SCSI Cabling

The controller supports up to three Ultra2 SCSI channels. Each channel supports up to 15 devices.

LVD Mode

The controller supports Ultra2 SCSI with LVD. If all drives attached to a controller drive channel support Ultra2 SCSI with LVD, then that channel will operate at 80 MB. This setup allows a maximum SCSI bus length of up to 12 meters.

> **Note**
>
> The SCSI bus length can be extended up to 25 meters if only the controller and one drive are on the bus in a point-to-point configuration.

Single-ended Mode

If any device on the channel does *not* have LVD electrical characteristics, the channel will revert to single-ended operation mode. The SCSI bus lengths will then be limited to the single-ended bus lengths shown in Table 2-1.

Table 2-1. Supported SCSI Formats and Bus Lengths

SCSI Trade Association (STA) Terms	Bus Speed, MB/Sec, Max.	Bus Width, Bits	Max. Bus Length, Meters		Max. Device Support (Including Controller)
			Single-ended	Low-Voltage Differential	
SCSI-1	5	8	6	-	8
Fast SCSI	10	8	3	-	8
Fast Wide SCSI	20	16	3	-	16
Ultra SCSI	20	8	1.5	-	8
Ultra SCSI	20	8	3	-	4
Wide Ultra SCSI	40	16	-	-	16*
Wide Ultra SCSI	40	16	1.5	-	8
Wide Ultra SCSI	40	16	3	-	4
Ultra2 SCSI	40	8	Not Defined	12†	8
Wide Ultra2 SCSI	80	16	Not Defined	12†	16

* The Maximum number of devices allowed on a Wide Ultra SCSI bus is 8, unless bus extender technology is used.

† This length can be extended to 25 meters if there are only 2 devices (e.g., the controller and one drive) on the bus in a point-to-point configuration.

SCSI Drive Preparation

To prepare the drives for installation follow these steps:

1. Remove any terminators attached to the drive or set any drive termination jumpers to the *disabled* position.
2. Set the SCSI IDs on the drives.
3. Enable term power on the drives.

Refer to the drive manual for specific information about drive configuration settings.

To get best performance from the controller, distribute the drives equally across the SCSI channels, and set the controller's data transfer rate to the optimum for the drives being used.

Mixing Narrow and Wide SCSI Drives

Do not mix narrow and wide SCSI devices on a single channel. If mixing of narrow and wide SCSI devices is desired, dedicate at least one channel to narrow SCSI, and at least one channel wide SCSI.

Mixing LVD with Single-ended Drives

If LVD capable drives are installed on a channel with single-ended drives, all drives on the channel will operate as if they were single-ended drives. This will also limit the bus length to the single-ended bus length specified in Table 2-1.

Chapter 3
Installation

This chapter describes:

- **Preparation**
- **Connectors and jumpers**
- **Safety considerations**
- **Controller installation procedures**

Before You Begin

Installing the eXtremeRAID 1100 DAC1164P PCI to Ultra2 SCSI RAID controller is no more difficult than installing any PCI adapter card. Follow these steps and the installation procedures in this chapter.

> **WARNING**
>
> **Working with the system covers off and power applied to the system can result in shock and serious injury.**

1. Power off the system and disconnect the power cables before starting the installation. Refer to the instructions provided in your system documentation. Do not disconnect cables or power cords while system power is on.
2. Read all of the instructions in this chapter completely before proceeding. Follow the Notes, Cautions, and Warnings described in this manual and marked on the equipment.
3. Follow electrostatic discharge (ESD) safe procedures. Use a grounded wrist strap or ESD safe footwear, and work in an ESD safe area.
4. Perform a safety check of the installation before powering on the system.
   - Make sure that all of the cabling Pin 1 locations are correct and that all cables are firmly seated in the connectors.
   - Make sure all SCSI conventions (cable type, cable length, termination, etc.) are correct.

Connectors, Jumper and LEDs

Up to three Ultra2 SCSI channels are supported on the controller. The SCSI connector locations are shown in Figure 3-1 and Figure 3-2.

All the jumpers should normally be set to their (default settings). See Table 3-1 for default jumper settings. Jumper locations are shown in Figure 3-1.

The controller has 15 LEDs that are active indicators while the controller is running. The LEDs indicate termination type and status, SCSI activity, cache status, diagnostic status, and host activity. The LED locations and meanings are shown in Figure 3-1.-

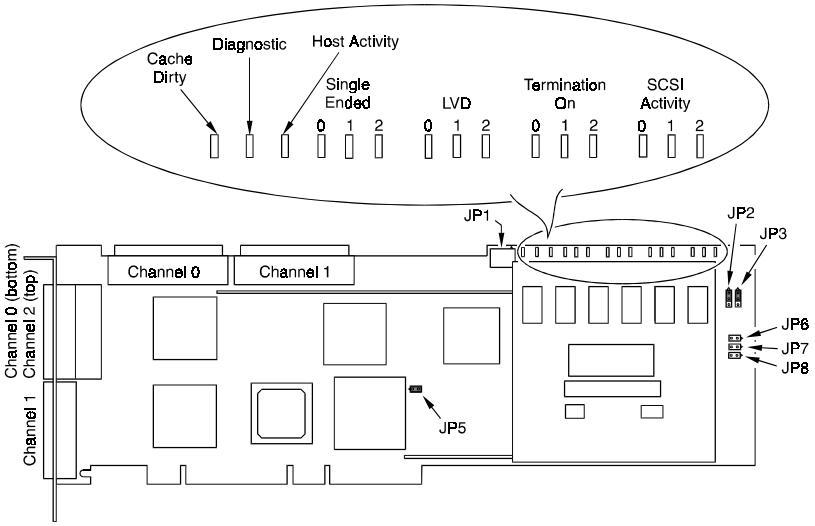


Figure 3-1. DAC1164P Controller with Jumpers, LEDs and Connectors

Table 3-1. Jumper Descriptions

Jumper	Description	Default Setting
JP1	factory use only	–
JP2	pins 1–2 for Arm Proc, pins 2–3 for I2O	1–2
JP3	pins 1–2 normal , pins 2–3 blank ROM mode	1–2
JP5	must be installed	on
JP6	maintenance – do not use	off
JP7	ROM emulator – do not use	off
JP8	Mylex manufacturing diagnostics – do not use	off

External SCSI Connectors

The external SCSI connectors on the controller are female, *Very High Density Cable Interconnect* (VHDCI) connectors.

The cables should have the VHDCI offset connector at one end and a High Density, 68-pin connector at the other end. Such cables with the correct offset hood and connector assembly are required if cables are to be connected to external channels 0 and 2 at one time.

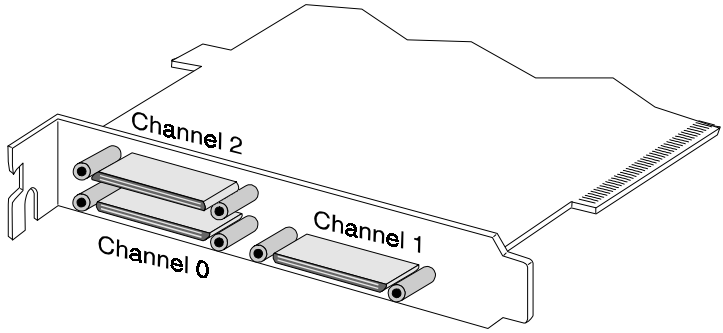


Figure 3-2. DAC1164P Controller External Connectors

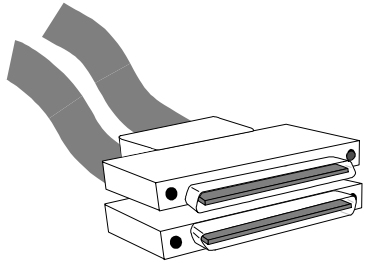


Figure 3-3. Offset Hood Cable Assembly Alignment

* Where *xx* is the cable length in meters.

Safety Considerations

Be sure to observe the following precautions before beginning the controller installation procedure:

⚠ *Caution*

Anti-static handling procedures are required. Leave the controller in its anti-static bag until it is time to plug the controller into the PCI slot. The use of a grounded wrist strap and other ESD protective measures are highly recommended.

STOP WARNING

Disconnect the system from the electrical wall outlet before opening the system cabinet. Working with the system covers off and power applied to the system can result in shock and serious injury.

Installing the Controller

> ⚠ ***Caution***
>
> Anti-static handling procedures are required. Leave the controller in its anti-static bag until it is time to plug the controller into the PCI slot. The use of a grounded wrist strap and other ESD protective measures are highly recommended.

Follow these steps:

1. Power off the system.
2. Power off all enclosures.
3. Disconnect system and enclosure power cords.
4. Remove the covers or the cabinet as necessary to access the I/O slots on the system board.
5. Choose a vacant PCI slot and remove the metal cover plate from the slot's access port (usually at the back of the cabinet). Save the retaining screw.
6. Plug the controller firmly into the PCI slot so that the controller's external connectors can be accessed through the access port. Use the retaining screw to secure the controller by its mounting bracket.

   > ☞ **Note**
   >
   > Although the DAC1164P controller will operate very well in a 32-bit PCI slot, a 64-bit PCI slot (if available) is recommended for optimum performance. If the system board contains both 32-bit and 64-bit PCI slots, the 64-bit slots are the longer ones.

7. Connect the cables from the disk array(s) to the drive channel port(s) on the controller.
8. Look to confirm that all drive channels in use are properly terminated.
9. **Safety check** the installation.
10. Reconnect the power.
11. Proceed to the next chapter.

Chapter 4
Controller Start-up

This chapter describes:

- **Start-up procedures**
- **BIOS options**
- **BIOS Configuration Utility**
- **Driver Installation**
- **What to check in case of problems**

This chapter describes the DAC1164P controller start-up procedures and messages produced by the BIOS during start-up or re-boot. This chapter also explains three BIOS options that are available for configuring controller operation.

Procedural Overview

The steps covered in this chapter include:

- Setting BIOS options
- RAID EzAssist (theBIOS configuration utility) – see the *RAID EzAssist Configuration Utility User Reference Guide* (P/N 775029) for configuration instructions and default controller parameter definitions.
- Loading the operating system and operating system drivers – see the *Disk Array Controller Software Kit Installation Guide and User Manual* (P/N 771929) for installation instructions for operating system drivers and the GAM server module.
- Installing Global Array Manager – see the *Global Array Manager Client Software Installation Guide and User Manual* (P/N 771961) for installation instructions for the GAM client.

Controller Start-up

The controller start-up procedure is the first step in confirming that the controller is correctly installed and working properly. The start-up procedure should be performed prior to any software configuration. There are two start-up sequences: the BIOS Options sequence and the BIOS Configuration Utility sequence. Either start-up sequence can be skipped by ignoring the <ALT-M> and/or the <ALT-R> prompt when the computer is started up.

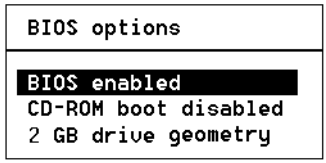
BIOS Options Sequence

After physically installing the controller and connecting the cabling, do the following steps if you need to set or modify the BIOS options (see “Setting BIOS Options” on page 4-3 for details:

1. Power on the computer.
2. Watch the messages on the screen for the following prompt to be displayed:

```
Press <ALT-M> for BIOS options
```

3. Press **Alt**–**M** to get into the *BIOS Options* menu.
4. The *BIOS Options* menu provides the following items to choose from:



5. To select any of the items in the menu, highlight the selection with the **Up Arrow** or **Down Arrow**. Press **Enter** to toggle any of the 3 items.

> ☞ **Note**
>
> BIOS must be enabled to toggle the CD-ROM boot and the Drive geometry parameters.

Setting BIOS Options

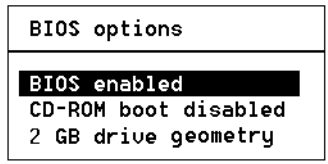
The available BIOS options are:

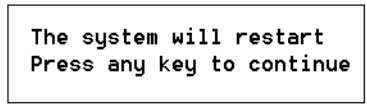
- BIOS disabled / enabled
- CD-ROM boot disabled / disabled
- 2GB / 8GB drive geometry

BIOS Disable or Enable

This option must be enabled in order to toggle the CD-ROM boot and the drive geometry parameters shown in the BIOS Options menu. The BIOS must also be enabled in order to boot from any device (e.g., CD-ROM) or system drive configured on the controller, or to access any DOS partition on any drive configured on the controller.

When BIOS Disable or Enable is selected, the following message will be displayed. Pressing any key will restart the system.





CD-ROM Boot Disable or Enable

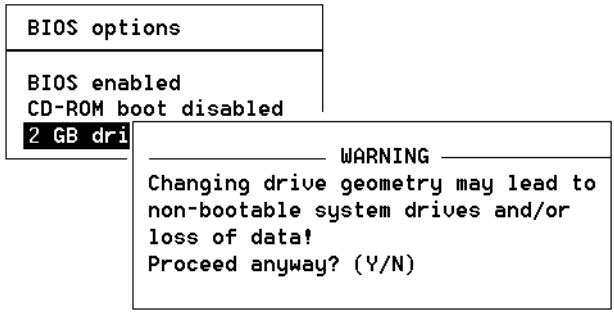
The default for this option is for the CD-ROM boot to be disabled (e.g., the system will boot from a hard drive, even if there is a bootable CD installed. If the CD-ROM boot option is enabled, and if a bootable CD is installed in the CD-ROM drive, the system can boot from the CD.

If the CD-ROM boot option is enabled, the CD-ROM will take priority over the disk drives. For example, under MS-DOS, the disk drive that is normally *Drive C* will become *Drive D*. All subsequent drive IDs will similarly be moved down.

Enable 8GByte or 2GByte Drives

This setting affects how the BIOS reads the disk drives for the boot partition. Drive geometries can be toggled between 8 GB and 2 GB. The default is 2 GB. When the drive geometry is changed, the drive should be formatted at the operating system level.

> ⚠ ***Caution***
>
> Changing this setting after data has been stored will make the data unreadable. If you have already configured your array and have stored data, you should *not* change this setting.



The default BIOS geometry of the controller is set to 2 GB. This means that the BIOS can only access the first 2 GB of any drive that has been configured on the controller. This is adequate in most applications, since BIOS is only used to boot the operating system. However, it does mean the operating system must be installed in the first 2 GB of the capacity of the configured drive. If this is not adequate, the BIOS geometry can be changed to 8 GB, allowing the BIOS to access the first 8 GB of capacity.

As a rule of thumb, select 8 GB geometry if the following two cases apply:

1. You have a system (RAID) drive that is greater than 2.145 GB in capacity.
2. The DOS/Windows compatible partitions could be located in an area above the first 2.145 GB.

Otherwise the 2 GB option is fine.

Note

In the event that the RAID controller needs to be replaced, the current drive geometry will be restored from the configuration on disk (COD).

Using RAID EzAssist

RAID EzAssist, the on-board BIOS Configuration Utility is used to build several types of RAID configurations. Since this is a Quick Installation Guide, only the Automatic Configuration option will be described here.

The following limitations apply to Automatic Configuration:

- Only one array will be configured using the Automatic Configuration option.
- All drives being controlled by the eXtremeRAID board can be different sizes, but will all be formatted to the size of the smallest disk controlled by the eXtremeRAID board.
- A maximum of 7 drives can be configured into an array using Automatic Configuration. Any additional drives will become hot spares. The drives with the largest capacity (if mixed drive sizes are used) will be the drives selected to become hot spares.

Note

If you want to do anything other than an automatic configuration, refer to the *RAID EzAssist Configuration Utility User Reference Guide*.

To perform a RAID configuration with the Automatic Configuration option using RAID EzAssist, do the following:

1. Power on the computer. The eXtremeRAID controller is furnished with the BIOS enabled by default.
2. Watch the messages on the screen for the following prompt to be displayed:

   ```
   Press <ALT-M> for BIOS options
   ```

   Wait approximately 5 seconds. Do *not* press any keys at this time.

Note

If the BIOS has been disabled on the controller, You will need to press Alt–M to enable it (See your controller's Installation Guide for details).

3. Watch the messages on the screen for the following prompt to be displayed:

```
Press <ALT-R> for RAID Configuration options
```

4. Press **Alt–R** to get into RAID EzAssist (the configuration utility).

Note

For more detailed information on how to run RAID EzAssist, refer to the *RAID EzAssist Configuration Utility User Reference Guide* (P/N 775029), which is included on the distribution CD-ROM.

Operating System

If an operating system is not already installed on the system, it can be installed on a system disk on the controller. The operating system is installed along with the operating system device drivers.

Operating System Device Drivers

Device drivers that are compatible with the controller can be found in the Software Kit. For details on how to install and load drivers, refer to the *DAC960 Software Kit Installation Guide and User Manual* (P/N 771929).

Global Array Manager (GAM)

The controller can be configured using GAM. GAM can also be used from the server or a system client to monitor status and verify data integrity of disks connected to the controller while the system and disks are running.

For details on how to install and run GAM, refer to the *Global Array Manager Client Software Installation Guide and User Manual* (P/N 771961). This manual can be downloaded at no cost from the Mylex web site (www.mylex.com).

In Case of Problems

If problems are encountered during start-up, check the following:

- Check SCSI cabling for loose connections, pin mismatches (make sure pin 1 on the cable matches pin 1 on the connector), bent pins, and damaged or crossed cables.
- Check cable length. This includes internal bus lengths in enclosures.
- Check termination.
- Check SCSI IDs on all drives.

Appendix A
Memory Module and Battery Backup Unit

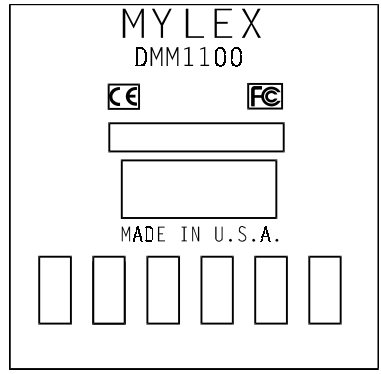


Figure A-1. DMM1100

Product Description

The Synchronous Dynamic Memory Module and Battery Backup Unit (DMM1100) is a cache memory module that maintains data integrity in the event of a power failure. The battery backup portion of this module monitors the write back cache on the DAC1164P controller, and provides power to the cache if it contains data not yet written to the drives when power is lost.

The controller, with the DMM1100 installed, together occupy only one PCI slot on the host backplane.

Features

Some of the features of the DMM1100 include:

- Gas gauge circuit for battery charge monitoring
- Quick charge to replenish a drained battery
- SDRAM on the DMM1100 module

DMM1100 Operation

This DMM1100 consists of 16 MB, 32MB, or 64MB of SDRAM cache memory, a rechargeable nickel-cadmium battery, a charging circuit, and power monitoring circuitry. The controller is shipped with the DMM1100 installed, and will not function without it.

Battery Conditioning Prior to Use

Battery conditioning is automatic. There are no manual procedures for battery conditioning or preconditioning to be performed by the user.

Set-up – Enabling the Write-Back Cache

Maximum RAID performance is achieved when the cache is in write-back mode. The write-back cache is enabled by toggling the write-back/write-through mode switch. The write-back/write-through mode switch is accessed using RAID EzAssist (the BIOS Configuration Utility), or in GAM. Refer to the *RAID EzAssist Configuration Utility User Reference Guide* or the *Global Array Manager Client Software Installation Guide and User Manual* for instructions on how to examine and change the mode switch.

Battery Backup Capacity

The battery backup's capacity varies with the cache memory capacity used. In the event of a power failure, the battery backup can be expected to maintain cache data integrity for the periods of time shown in Table A-1.

Table A-1. Battery Backup Capacity

Memory Size	Approximate Battery Charge Life
64MB	48 hours
32MB	72 hours
16MB	72 hours

Maintenance

No maintenance is required. It is recommended that the DMM1100 charge level be periodically checked using the Gas Gauge function in GAM (see the *Global Array Manager Client Software Installation Guide and User Manual*).

Removing the DMM1100

The DMM1100 only needs to be removed if the NiCd battery no longer accepts a charge properly (NiCd battery life expectancy is approximately 5 years), or if the DMM1100 is being salvaged from a controller that has failed.

WARNING

Replace the battery only with the same or equivalent type of battery recommended by the battery manufacturer. Dispose of used batteries as described under "Recycling the Battery" on page A-5.

DMM1100 Functional Description

Whenever the system is running, the DMM1100's battery backup circuitry is standing by, monitoring the voltage level of VCC. In the event of a power failure, the VCC voltage level will begin to drop. When the battery backup circuitry detects this voltage drop, it checks the status of the disk cache. If the cache is empty, the battery backup circuitry does nothing.

If the cache contains data during a power failure, the DMM1100's battery backup circuitry will maintain cache data integrity until the power is restored. When power is restored and the system finishes the bootstrap process, the cache contents will be written to the disk array. The cache contents will then be flushed from the cache.

Status Indication

The status of the battery can be checked with the gas gauge feature that can be accessed in GAM (version 2.1x or greater is needed). The gas gauge appears on the screen as two meters— a battery power meter and a charge level meter— each calibrated from 0 to 100.

The battery power meter indicates the battery capacity in hours. It will indicate a charge duration of up to 100 hours. The firmware will detect the memory and assign a value based upon the charge level of the battery and the power consumption rate of the memory.

The charge level meter displays the charge state of the battery expressed in percent (100% indicates a fully charged battery).

When the meter on the right indicates the battery is fully charged, the meter on the left will indicate the maximum time in hours (approximately 48 hours for a 64MB cache or 72 hours for a 32MB or 16MB cache) that the battery can be expected to maintain cache data integrity.

Note

When the charge level is 100%, the *current number of hours* and *maximum number of hours* (printed out below the left dial) will be equal.

Battery and Charge Circuit

On-board Battery

The on-board battery is rated at 3.6 v with a capacity of 650 mAH. The DMM1100 has a DC-DC converter that converts 3.6 v to 3.3 v, which is the nominal voltage required for the cache.

Battery Charger

Battery charging and conditioning are automatically handled by the DMM1100. No manual preconditioning needs to be performed by the user. If the battery capacity falls below a predetermined level (which is likely to happen after a power failure), the battery charger goes into a quick charge mode. If the battery is fully charged, the charger goes into a trickle charge mode.

Recycling the Battery

The on-board battery that comes with the DMM1100 has the logo of the Rechargeable Battery Recycling Corporation (RBRC) stamped on it. The logo means that recycling fees have been prepaid on this battery pack.

> ⚠ ***Caution***
>
> Do not dispose of a rechargeable battery with regular trash in a landfill. Rechargeable batteries contain toxic chemicals and metals that are harmful to the environment. Improperly disposing of rechargeable batteries is also illegal.

Figure A-2. RBRC Logo

The RBRC is a non-profit corporation that promotes the recycling of rechargeable batteries, including nickel-cadmium batteries.

Information on the RBRC program and the locations of participating recycling centers can be obtained by telephoning 1–800–8–BATTERY (in the USA), and following the recorded instructions. The information obtained from this telephone number is updated frequently, since the RBRC program is growing, and new recycling locations are being added regularly.

DMM1100 Specifications

On-board Battery

Electrical Properties

- 3 NiCd 1.2 V, 650 mAH cells, connected in series for a total of 3.6V at 650mAH

Physical Description

- Nominal pack size (in inches): 1.89(L) X 2.01(W) X 0.33 (H)

Battery Charge Life

Approximately 48 hours with 64MB SDRAM
Approximately 72 hours with 32MB or 16MB SDRAM

Cache Memory

16MB, 32MB, or 64MB SDRAM

Module Dimensions

Length:	3.625 inches
Width:	4.0 inches

Environmental

Temperature	Operating:	0ºC to +50ºC (+32ºF to 122ºF)
	Storage:	-40ºC to +60ºC (-40ºF to +140ºF)
Humidity	Operating:	45% to 85% relative humidity (non-condensing)
	Non-operating:	45% to 85% relative humidity (non-condensing)

Warranty

3-Year, Limited

Appendix B
DAC1164P Specifications

General Hardware Specifications

eXtremeRAID 1164

Controller	DAC1164P
CPU	StrongARM™ 32-bit microprocessor, 233MHz
Memory	SDRAM, 16MB, 32MB, or 64MB installed on a module containing a battery with backup circuitry for power fail protection of data
Cache	Write: Selectable, Write Through or Write Back Error Protection: Parity
Firmware	ROM Type, Flash EEPROM, 1MB x 8
PCI	64-bit or 32-bit PCI at 33MHz, 3.3v or 5v.
SCSI	Supports 3 Symbios Ultra2 LVD SYM53C895 PCI to Ultra2 SCSII I/O Processors

Environmental Specifications

Controller	**DAC1164P**	
Temperature	Operating	0°C to +55°C (+32°F to 131°F)
	Storage	-20°C to +70°C (-4°F to +158°F)
Humidity	Operating	10% to 90% relative humidity (non-condensing)
	Storage	10% to 90% relative humidity (non-condensing)
Altitude	Operating	Up to 3,048m (10,000 ft)
	Storage	Up to 15,240m (50,000 ft)
Form Factor	Length:	12.280 inches
	Width:	4.750 inches
	Maximum. Component Height:	0.105 inches on the solder side of the board 0.570 inches on the component side of the board
Maximum Power Consumption	at 5.25v	1.90A (9.98W) with 64MBytes SDRAM
	at 4.75v	1.85A (8.79W) with 64MBytes SDRAM
MTBF		244,547 hours at 55°C

Appendix C
DAC1164P Error Messages

Error Messages

Start-up Error Messages

The BIOS looks for any initialization message posted by the firmware during the start-up sequence. If a message is found, one of the following errors displays on screen and the installation process aborts.

```
DAC1164Pn fatal error--memory test failed
DAC1164Pn fatal error--command interface test failed
DAC1164Pn hardware error--run diagnostics to pinpoint
error
DAC1164Pn firmware checksum error--reload firmware
```

Drive Check Error Messages

If the firmware finds a valid controller configuration, but it doesn't match the SCSI drives currently installed, one or more of the following messages display:

```
Unidentified device found at channel x....
Device identified for chn x, tgt y found at chn x', tgt y'
SCSI device at chn x, tgt y not responding
```

If any of the above messages are displayed, the firmware will not proceed any further in the initialization process, except to find other mismatches. Then, the BIOS prints out the following:

```
DAC1164Pn Configuration Checksum error--run configuration
utility
```

If the firmware detects that during the last power cycle the system was turned off abruptly leaving some incomplete write operations, the following message appears:

```
Recovery from mirror race in progress
```

The following messages may also appear:

```
Adapter cannot recover from mirror race!
```

```
Some system drives are inconsistent!
```

During the initialization, if the firmware fails to respond to the BIOS inquiry within two minutes, the following message displays:

```
DAC1164Pn not responding--no drives installed.
```

The BIOS then inquires the firmware for its version number and other information, and prints out the following message:

```
DAC1164Pn firmware version x.xx
```

One or more of the following messages will be displayed if the firmware reports the following conditions:

```
Warning: X system drives are offline

Warning: X system drives are critical

Warning: The following SCSI devices are dead--chn
x, tgt y...

No system drives found: None installed

X system drives installed
```

The BIOS repeats the same process for additional RAID controllers present in the system. Then it proceeds to boot, if possible, from the first system drive on the first controller.

Aborted Installation

With Firmware 5.x, the installation aborted message is displayed when the BIOS finds that the configuration of the disk drives, as stored in the NVRAM and configuration on disk, is different from what it senses at boot time. When this happens, (and a brand new installation is not being attempted) the cause is often a faulty cable or drive, or a loose connection. Check all of the connectors, cables, drives, and try to boot. If the error persists, it most likely indicates a genuine failure and needs to be corrected. To correct it, boot and run the on-board BIOS Configuration Utility, RAID EzAssist (see Chapter 4). For more information, refer to the *RAID EzAssist Configuration Utility User Reference Guide* (P/N 775029).

NVRAM Error

With Firmware 5.x, if the BIOS displays a mismatch between the NVRAM and the Configuration on Disk (COD), no drives will be installed. Normally this error will not be displayed. If it is, boot and run RAID EzAssist, the on-board Mylex Disk Array Configuration Utility (see Chapter 4). to recover from the error. For more information, refer to the *RAID EzAssist Installation Guide and User Manual*.

System Reboot or Power Down

Status messages may also be available from LED indicators connected to the controller. The Cache Dirty indicator is especially important when preparing to power-down the system.

The DAC1164P controller is a caching controller with 16MB, 32MB, or 64MB of cache memory, data may still be in the cache waiting to be written to the disk drives, when the system reports that a write command was completed. It is *very important* to make sure that all data is written to the disk before rebooting or powering down the system, or you may lose data. It is always a good idea to wait for 15 seconds before resetting or rebooting the system.

If using the 'Cache Dirty' LED indicator, wait 3 seconds after the LED has gone off before resetting or rebooting the system (the cache battery backup may also be used to prevent data loss).

Appendix D
PCI Hot Plug

Introduction

PCI Hot Plug is a feature that allows a PCI card to be replaced while the host system is still running. The term “Hot Plug” is somewhat misleading; the PCI card cannot simply be pulled out of the host system while the card is operating without risk to the card, the system, and the data on the system.

In order to replace a Hot Plug PCI card, a software command must be invoked to power off the card slot before the card can be removed. After the software indicates that the card is unloaded and the slot is powered off, a physical card retainer/switch must be released to allow the card to be removed from the PCI bus. At this point, the card can be replaced.

At this time, Mylex only supports Hot Replacement of PCI Hot Plug cards. Future releases are planned to support Hot Upgrade or Hot Expansion (adding a card).

Implementation

Aside from the general terms previously mentioned, PCI Hot Plug implementation is specific to the host hardware platform and the operating system running on it. Refer to your host system's documentation for specific details on how to implement PCI Hot Plug.

NetWare

When NetWare is installed on a system capable of PCI Hot Plug, the following four modules are installed:

- cpqsbd.nlm - This is the Compaq system bus driver (a different driver will be needed for a platform other than Compaq).
- ncm.nlm - This is the Novell Configuration Manager, which manages the PCI Hot Plug system.
- ncmcon.nlm - This is the Hot Plug user interface called the Novell Configuration Manager Console.

- odineb.nlm - This is a module combining the Open Data-link interface and the Novell Event Bus (NEB). The NEB controls the device drivers through the Open Data-link.

If the NetWare installation process determines that the server supports PCI Hot Plug and detects the appropriate driver, the installation process adds the following two LOAD commands to the autoexec.ncf file:

- LOAD sys:\system*driver_name*

  This command loads the bus driver (for Compaq, this is ***cpqsbd.nlm***). After this command is executed, NetWare autoloads ncm.nlm.

- #LOAD sys:\system\ncmcon.nlm

  This command loads the Novell Configuration Manager Console, which then loads odineb.nlm. These commands can also be executed at the server console prompt.

> ☛ **Note**
>
> This command is commented out. If you want the Configuration Manager Console to be loaded every time the system is started, remove the pound sign (#) at the beginning of the line.

Perform the following steps:

1. Install NetWare 5 Service Patch 1.
2. Install the Mylex GAM DMI driver.
3. Restart the server. The autoexec.ncf will execute and it will load the drivers and start *ncmcon.nlm* (the PCI Hot Plug user interface).

> ☛ **Note**
>
> If any LOAD line is commented out in *autoexec.ncf*, the corresponding driver can be loaded manually by executing the LOAD command (as listed in *autoexec.ncf*) at the server console prompt.

Windows NT

Windows NT requires additional software from the vendor who makes the system. Since this software is not a part of NT, the software needs to be installed after the operating system is loaded. Refer to your vendor's PCI Hot Plug documentation.

> ⚠ ***Caution***
>
> GAM drivers can stop PCI Hot Plug Boards from unloading. If this problem occurs, stop GAM and unload the GAM drivers before attempting to unload the PCI Hot Plug controller.

Known Windows NT Issues

- Mylex Software Kit 2.1 or greater is required to support your system vendor's PCI Hot Plug utility.
- The *macdisk.sys* driver should not be loaded with a Mylex PCI Hot Plug board; if *macdisk.sys* is loaded the system will hang upon shutdown.
- When you install a Mylex card as a boot device and a Mylex Driver has been installed prior to the installation of the Windows NT OS, NT will not recognize the Mylex card as a PCI Hot Plug device. To fix this, the driver must be reinstalled, and the system rebooted.

  This problem occurs because PCI Hot Plug information does not get loaded into the Windows NT registry for the Mylex controller upon installation of Windows NT.

Appendix E
Enclosure Management

Introduction

Mylex's eXtremeRAID controllers support the industry standard enclosure management protocol *SCSI Accessed Fault-Tolerant Enclosures* (SAF-TE). This feature allows the host to monitor drive enclosures and detect certain faults or operating environment conditions. The host can make a decision to shut down the system or issue a warning based on the type of fault detected.

SAF-TE

The SAF-TE protocol follows a specification jointly worked out by nStor Corporation and Intel Corporation. Enclosures that are compliant with this protocol are known as SCSI Accessed Fault-Tolerant Enclosures (SAF-TE). The protocol is compatible with standard SCSI buses and cabling.

The SAF-TE interface standard's objective is to provide a non-proprietary means of allowing third-party disks and controllers to be automatically integrated with peripheral enclosures that support:

- Status Signals (LEDs, audible alarms, LCDs, etc.)
- Hot swapping of drives
- Monitoring of fans, power supplies, and enclosure temperature

SCSI is the underlying transport mechanism for communicating enclosure information. All standard SCSI host adapters will work. There is no need to consider reserved signals or special cabling.

The SAF-TE interface can be implemented as a SCSI target that uses a SCSI port and an 8-bit microcontroller.

All communication is initiated by the host. The SAF-TE processor acts only in target mode. The SAF-TE processor should be periodically polled by the host approximately every 2 to 10 seconds.

StorageWorks

The eXtremeRAID 1100 supports Compaq StorageWorks™ enclosure management. Refer to the documentation supplied with your StorageWorks enclosure for details on how to take advantage of this feature.

Appendix F
Regulatory Information

FC Class B Compliance

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS:

4. THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND
5. THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

All external connections should be made using shielded cables.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is not guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna
2. Move the equipment away from the receiver
3. Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions.

⚠ *Caution*

Only equipment certified to comply with Class B (computer input/output devices, terminals, printers, etc.) should be attached to this equipment.

Any changes or modifications to the equipment by the user not expressly approved by the grantee or manufacturer could void the user's authority to operate such equipment.

FC Declaration of Conformity

Per FCC Part 2, Section 2.1077(a)

Manufacturer's Name: Mylex Corporation
Manufacturer's Address:34551 Ardenwood Blvd.
Fremont, CA 94555-3607
USA

Declares that the product:

Product Name: High Performance RAID Controller

Model Number(s):DAC1164P-xx

Year of Manufacture:1998

Conforms to the following Product Specification(s):

FCC:CFR 47 Part 15, Subpart B, Section 15.107(e) and Section 15.109(g) Class B Digital Device tested per ANSI C63.4–1992 procedures

Supplementary Information:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CE Declaration of Conformity
Per 89\336\EEC

Responsible Party
Name: Mylex Corporation
Address: 34551 Ardenwood Boulevard
Fremont, CA 94555-3607 USA

hereby declares that the product

Trade Name: High Performance Caching RAID Controller
Model Number: DAC1164P-3E Fab. 550137-A Rev. A

conforms to the following specifications

Standards: EN 50081-1:1992, EMI
EN 55022 Class B (Radiated), Class B (Conducted)

EN 50082-1:1992, Immunity
EN 61000-4-2:1995 Electrostatic Discharge
EN 61000-4-3:1996 Radiated Susceptibility
EN 61000-4-4:1995 Electrical Fast Transients/Burst

CE Community of Europe

CE mark is rated for the eXtremeRAID as follows:

CISPR 22 Radiated Emission

EN55022, EN5082-1 Generic immunity standard for the following:
IEC 801-2 ESD, IEC 801-3 Radiated, and IEC 801-4 EFT/Burst

Warning!

This is a Class B product. In a residential environment this product may cause radio interference, in which case the user may be required to take adequate measures.

Achtung!

Dieses ist ein Gerät der Funkstörgrenzwertklasse B. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen aufreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Avertissement!

Cet appareil est un appareil de Classe B. Dans un environnement résidentiel cet appareil peut provoquer des brouillages radioélectriques. Dans ce cas, il peut être demandé à l'utilisateur de prendre des mésures appropriées.

Underwriters Laboratories Statement and Warning

WARNING

This controller is furnished with a nonvolatile RAM (NVRAM) chip that uses a sealed lithium battery/crystal module. Replace the module only with the same or equivalent type recommended by the manufacturer. Dispose of the used battery/ crystal module according to the manufacturer's instructions. Never incinerate a battery as it could explode and cause serious injury.

Glossary

Cache

Controller memory used to speed up data transfer to and from a disk.

Cache Flush

Refers to an operation where all unwritten blocks in a Write-Back Cache are written to the target disk. This operation is necessary before powering down the system.

Cache Line Size

The Cache Line Size function is set in conjunction with stripe size and represents the size of the data “chunk” that will be read or written at one time. Under RAID EzAssist, the cache line size (also known as “segment size”) should be based on the stripe size you selected. The default cache line size for Mylex eXtremeRAID controllers is 8K.

Channel

Refers to one SCSI bus on a disk array controller. Each disk array controller provides at least one channel.

Consistency Check

Refers to a process where the integrity of redundant data is verified. For example, a consistency check of a mirrored drive will make sure that the data on both drives of the mirrored pair is exactly the same. For RAID Level 3 or RAID Level 5, a consistency check makes sure that all parity data is correct.

Disk Failure Detection

The controller automatically detects SCSI disk failures. A monitoring process running on the controller checks, among other things, elapsed time on all commands issued to disks. A time-out causes the disk to be “reset” and the command to be retried. If the command times out again, the disk

could be “killed” (taken “offline”) by the controller (its state changed to “dead”). DAC1164 controllers also monitor SCSI bus parity errors and other potential problems. Any disk with too many errors will also be ‘killed’.

Disk Media Error Management

DAC1164 controllers transparently manage SCSI disk media errors. Disks are programmed to report errors, even ECC-recoverable errors. If ECC EDO RAM is installed, the controller will correct ECC errors.

When a disk reports a media error during a read, the controller reads the data from the mirror (RAID 1 or 0+1), or computes the data from the other blocks (RAID 3, RAID 5), and writes the data back to the disk that encountered the error. If the write fails (media error on write), the controller issues a “reassign” command to the disk, and then writes the data to a new location. Since the problem has been resolved, no error is reported to the system.

> ☞ **Note**
>
> The soft error counter is incremented in this case. The soft error count can be viewed using the Mylex disk array configuration utilities.

When a disk reports a media error during a write, the controller issues a “reassign” command to the disk, and writes the data out to a new location on the disk.

Drive Groups (or Drive Packs)

A group of individual disk drives (preferably identical) that are logically tied to each other and are addressed as a single unit. In some cases this may be called a drive “pack” when referring to just the physical devices. Up to eight (8) drives can be configured together as one drive group.

All the physical devices in a drive group should have the same size, otherwise each of the disks in the group will effectively have the capacity of the smallest member. The total size of the drive group will be the size of the smallest disk in the group multiplied by the number of disks in the group. For example, if you have 4 disks of 400MB each, and 1 disk of 200MB in a pack, the effective capacity available for use is only 1000MB (5*200), not 1800MB.

Hot Replacement of Disks (Hot Swap)

The design of the DAC1164 controllers allows for the replacement of failed hard disk drives without interruption of system service. In the event of a SCSI drive failure on a properly configured system (where the data redundancy features of the controller are used), system service continues without interruption. A message is generated by the system to alert the system operator.

When a replacement drive becomes available, the system operator can remove the failed disk drive, install a new disk drive, and instruct the controller to "rebuild" the data on the new drive, all without interrupting system operations.

Once the rebuild is complete, the controller will be brought back into a fault tolerant state.

Logical Drive States

The state of a logical (system) drive can be either ONLINE, CRITICAL, or OFFLINE. Notice that the same term "online" is used for both physical and logical drives.

Online: A Logical Drive is in an "online" state if...

All of its participating SCSI drives are "online."

Critical: A Logical Drive is in a "critical" state if...

It has been configured at RAID level 1, 3, 5, or 0+1; and

One (and only one) of its SCSI drives is not "online."

A logical drive is considered "critical" because any failure of another of its SCSI drives may result in a loss of data.

> ☞ **Note**
>
> I/O operation can only be performed with system drives that are online or critical.

Offline: A Logical Drive is in an “offline” state if...

No data can be read from it or written to it.

System commands issued to offline logical drives are returned with an error status: no operations can be performed on offline logical drives. A logical drive can be “offline” under one of two situations described below:

- It is configured with a redundant RAID level (1, 3, 5, or 0+1), and two or more of its SCSI drives are not “online”; or
- It is configured at RAID level 0, JBOD, or in a spanned set, and one or more of its SCSI drives are not “online.”

Logical Drives

See “System Drives.”

Mirroring

Refers to the 100 percent duplication of data on one disk drive to another disk drive. Each disk will be the mirror image of the other.

Pack

See “Drive Groups (or Drive Packs).”

Parity

See “Rotated XOR Redundancy.”

RAID

RAID stands for Redundant Array of Independent Disks. The DAC1164 controllers implement this technology to connect up to 15 SCSI devices per channel. Several different forms of RAID implementation have been defined. Each form is usually referred to as a "RAID level." All the RAID levels supported by DAC1164 controllers are shown below.

The appropriate RAID level for a system is selected by the system manager or integrator. This decision will be based on which of the following are to be emphasized:

Disk Capacity

Data Availability (redundancy or fault tolerance)

Disk Performance

RAID Levels

The disk array controllers monitored by this utility support four RAID Advisory Board-approved (RAID 0, RAID 1, RAID 3, RAID 5) and two special RAID levels (RAID 0+1, and JBOD).

Level 0. Block "striping" across multiple drives is provided, yielding higher performance than is possible with individual drives. This level does not provide any redundancy.

Level 1. Drives are paired and mirrored. All data is 100 percent duplicated on a drive of equivalent size.

Level 3. Data is "striped" across several physical drives. Maintains parity information which can be used for data recovery.

Level 5. Data is "striped" across several physical drives. For data redundancy, drives are encoded with rotated parity.

Level 0+1. Combines RAID 0 striping and RAID 1 mirroring. This level provides redundancy through mirroring. (Mylex RAID 6)

JBOD. Sometimes referred to as "Just a Bunch of Drives." Each drive is operated independently like a normal disk controller, or drives may be spanned and seen as a single drive. This level does not provide data redundancy. (Mylex RAID 7)

Level 10. Combines RAID 0 striping and RAID 1 mirroring spanned across multiple drive groups (super drive group). This level provides redundancy through mirroring.

Level 30. Data is “striped” across multiple drive groups (super drive group). Maintains parity information which can be used for data recovery.

Level 50. Data is “striped” across multiple drive groups (super drive group). For data redundancy, drives are encoded with rotated parity.

> ☞ **Note**
>
> The host operating system drivers and software utilities remain unchanged regardless of the level of RAID installed. The controller makes the physical configuration and RAID level implementation

Replacement Table

A replacement table contains information regarding which SCSI devices have been replaced by others through standby replacement.

Rotated XOR Redundancy

This term (also known as “parity”) refers to a method of providing complete data redundancy while requiring only a fraction of the storage capacity of mirroring. In a system configured under RAID 3 or RAID 5 (which require at least three SCSI drives), all data and parity blocks are divided between the drives in such a way that if any single drive is removed (or fails), the data on it can be reconstructed using the data on the remaining drives. (XOR refers to the Boolean “Exclusive-OR” operator.) In any RAID 3 or RAID 5 array, the capacity allocated to redundancy is the equivalent of one drive.

SCSI Drive

A disk drive equipped with a SCSI interface (sometimes referred to as a SCSI Disk). Each disk drive will be assigned a SCSI address (or SCSI ID), which is a number from 0 to 7 (0 to 15 under wide or Ultra SCSI). The SCSI address uniquely identifies the drive on the SCSI bus or channel.

SCSI Drive States

Refers to a SCSI drive's current operational status. At any given time, a SCSI drive can be in one of five states: READY, ONLINE, STANDBY, DEAD, or REBUILD.

The controller stores the state of the attached SCSI drives in its non-volatile memory. This information is retained even after power-off. Hence, if a SCSI disk is labeled DEAD in one session, it will stay in the DEAD state until a change is made either by using a system level utility or after a rebuild. Each of the states is described below:

Ready: A SCSI disk drive is in a "ready" state if it...

Is powered on; and

Is available to be configured during the current session but remains unconfigured.

Online: A SCSI disk drive is in an "online" state if it...

Is powered on; and

Has been defined as a member of a drive group; and

Is operating properly.

Standby: A SCSI disk drive is in a "standby" state if it...

Is powered on; and

Is able to operate properly; and

Was NOT defined as part of any drive group.

Dead: A SCSI disk drive is in a "dead" state if it...

Is not present; or

If it is present but not powered on; or

If it failed to operate properly and was 'killed' by the controller.

When the controller detects a failure on a disk, it "kills" that disk by changing its state to "dead." A SCSI drive in a dead state does not participate in any I/O activity. No commands are issued to dead drives.

Rebuild: A SCSI disk drive is in a “rebuild” state...

While it is in the process of being rebuilt. During this process, data is regenerated and written to the disk drive. This state is also referred to as ‘Write-Only’ (WRO).

Segment Size

See “Cache Line Size.”

Session

Refers to the period of time between any two consecutive system shutdowns. System shutdown may be either a power off/on, or a hardware reset.

Standard Disk Drive

This term refers to a hard disk drive with SCSI, IDE, or other interface, that is attached to the host system through a standard disk controller.

Standby Replacement of Disks (“Hot Spare”)

The “Standby Replacement” (or “Hot Spare”) is one of the most important features the controller provides to achieve automatic, non-stop service with a high degree of fault-tolerance. The rebuild operation will be carried out by the controller automatically when a SCSI disk drive fails and both of the following conditions are true:

- A “standby” SCSI disk drive of identical size is found attached to the same controller;
- All of the system drives that are dependent on the failed disk are redundant system drives, e.g., RAID 1, RAID 3, RAID 5, RAID 0+1.

A “Standby” disk can be created in one of two ways:

3. When a user runs RAID EzAssist, all disks attached to the controller that are NOT configured into any drive group will be automatically labeled as “standby” drives.
3. A disk may also be added (attached at a later time) to a running system and labeled as standby by using the “DAC1164 Software Kit” (see appropriate chapters for DAC1164 utilities for a particular operating system).

During the automatic rebuild process, system activity continues as normal. System performance may degrade slightly during the rebuild process.

> ☞ **Note**
>
> The standby rebuild will only happen on the SAME DAC1164 controller, never across DAC1164 controllers.

To use the standby rebuild feature, you should always maintain a standby SCSI disk in your system. When a disk fails, the standby disk will automatically replace the failed drive and the data will be rebuilt. The system administrator can disconnect and remove the bad disk and replace it with a new disk. The administrator can then make this new disk a standby.

Stripe Order

The order in which SCSI disk drives appear within a drive group. This order must be maintained, and is critical to the controller’s ability to ‘Rebuild’ failed drives.

Stripe Size

The stripe size is defined as the size, in kilobytes (1024 bytes) of a single I/O operation. A stripe of data (data residing in actual physical disk sectors, which are logically ordered first to last) is divided over all disks in the drive group.

Stripe Width

The number of striped SCSI drives within a drive group.

Striping

Refers to the storing of a sequential block of incoming data across multiple SCSI drives in a group. For example, if there are 3 SCSI drives in a group, the data will be separated into blocks and block 1 of the data will be stored on SCSI drive 1, block 2 on SCSI drive 2, block 3 on SCSI drive 3, block 4 on SCSI drive 1, block 5 on SCSI drive 2 and so on. This storage method increases the disk system throughput by ensuring a balanced load among all drives.

System Drives

A system drive is equivalent to a “logical” drive. System drives are presented to the operating system as available disk drives, each with a capacity specified by the DAC1164 controller.

Target ID

A target ID is the SCSI ID of a device attached to a DAC1164 controller. Each SCSI channel can have up to 15 attached SCSI devices (target ID from 0 to 6, and 8 to 15).

Write-Back Cache

Refers to a caching strategy whereby write operations result in a completion signal being sent to the host operating system as soon as the cache (not the disk drive) receives the data to be written. The target SCSI drive will receive the data at a more appropriate time, in order to increase controller performance. An optional cache battery backup can be used to protect against data loss as a result of a power failure or system crash.

Write Through Cache

Refers to a caching strategy whereby data is written to the SCSI drive before a completion status is returned to the host operating system. This caching strategy is considered more secure, since a power failure will be less likely to cause loss of data. However, a write through cache results in a slightly lower performance.

MYLEX DAC1164P Problem Report

Customer Identification	DAC1164P Identification
Name: _____	Date: Purchase Date:
Company: _____	Model
Address: _____	Invoice Number:
_____	Serial Number:
_____	# Chnls: Cache:
Country: _____	Firmware Ver: BIOS Ver:
	Make/Model/Size/Type of
Phone Number:_____	Drives:
Fax Number:_____	Disk:
	Non-Disk:

System Information

Motherboard: _____	CPU Speed:	BIOS Ver:
Video Adapter: _____	Network Card:	MB Memory:
Operating Sys: _____	Other Disk Ctrl:	Other Cards:

Pack Configuration

Indicate in matrix below 1, 2... for member of pack 1, pack 2... respectively. Indicate S, T, C, or O for Standby, Tape, CDROM and other drives.

Channel	SCSI ID															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0																
1																
2																

System Drive Configuration

System Drive	Size	RAID Level	Write Back/ Thru
0			
1			
2			
3			
4			
5			
6			
7			

Problem Description

_____
_____
_____
_____
_____
_____
_____
_____

This DPR form has been included with your Mylex product as a convenience to both you and our Technical Services Department. If filled out completely, this will greatly assist Mylex personnel in quickly resolving any technical problems or questions you may have. Use the Mylex fax number (510) 745-7715 to transmit this form to the Technical Services Department, or mail to Mylex Corporation, Technical Services Department, 34551 Ardenwood Blvd., Fremont, CA 94555-3607

Mylex Warranty - Customer Policy

Thank you for purchasing this Mylex product for your computer system. In addition to this high-quality product, your purchase entitles you to the warranty coverage set forth herein. In order to provide this warranty coverage, and to indicate your acceptance of this warranty, we must have the attached Warranty Registration Card completed and returned to us within 15 days of your purchase. Also, in order for us to provide you the highest level of service, we must know where you purchased your MYLEX product.

Three Year Limited Warranty

If at any time during the thirty six month period immediately following the date of original purchase of the MYLEX product enclosed herewith (the "PRODUCT") you discover one or more defects in the material or workmanship, MYLEX will repair, or at MYLEX's sole option, replace the PRODUCT. If the PRODUCT fails to operate at any time within seven days after the date of its original purchase, it will be replaced by MYLEX. Such repair or replacement will be your sole remedy against MYLEX, and MYLEX's only liability to you, for any failure or malfunction of the PRODUCT. The warranty set forth in this paragraph will be void if:

1. The PRODUCT has been installed in an improper manner or in an improper operating environment.
2. The PRODUCT has been modified or repaired by any party other than MYLEX or a MYLEX factory authorized service center.
3. The PRODUCT has been damaged.

Some MYLEX products will have a Warranty Expiration Date label affixed to the product itself. When present, the warranty period will extend through the last day of the month indicated.

This warranty will not apply to, and MYLEX provides no warranty for, any BIOS, software, ROM-based firmware, or any other PRODUCT developed or manufactured by any third party, whether included with this PRODUCT or not. Such warranty or warranties as are provided by third parties, to the extent permitted thereby, shall be made available, and are hereby assigned, by MYLEX to the purchaser of this PRODUCT.

If MYLEX issues a revision to the BIOS, firmware or software included with this PRODUCT within 30 days of your purchase, MYLEX will replace such firmware at no charge except handling fees.

Out of Warranty Service

Mylex products which are ineligible for warranty service may be serviced by MYLEX according to our standard price list, as modified from time to time. A current copy of the standard price list is available from the Technical Support Department.

Limitation of MYLEX Liability

MYLEX's liability arising from the sale, use and disposition of this PRODUCT shall in no event exceed the amount paid to MYLEX for this PRODUCT. MYLEX assumes no liability for damages arising from the use or failure of any MYLEX product. The WARRANY DESCRIBED ABOVE CONSTITUTES THE ONLY WARRANY MADE BY MYLEX. MYLEX EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES OF ANY KIND WHATSOEVER, WHETHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY EXCLUDED. IN NO EVENT WILL MYLEX BE LIABLE FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OF DATA, USE, OR INCOME), EVEN IF ADVISED OF SUCH DAMAGES IN ADVANCE. Your sole remedies shall be as provided herein.

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Returned Merchandise Procedures

If you suspect that there is a defect in the material or workmanship of this PRODUCT, you should contact the person or company from which you purchased it. That person or company may be able to solve the problem and if not, will be able to contact us for technical assistance or repair.

If it is determined that the PRODUCT must be returned to MYLEX for repair or replacement, contact MYLEX's Technical Support Department at 510-608-2400 before it is returned. Each returned item must have a separate Return Merchandise Authorization (RMA) number, provided by MYLEX.

The following rules apply to all returned items:

1. The PRODUCT must be returned either in its original packaging or in other packaging which is appropriate for the PRODUCT and the manner of shipment, and the RMA number must be displayed prominently on the outside of each such package.

2. If a PRODUCT is determined to be ineligible for warranty service, the customer will be notified before any further action is taken with the PRODUCT.

3. MYLEX will not be responsible for any loss or damage to property shipped with the RMA PRODUCT not originally sold by MYLEX (e.g., coprocessor chips, peripheral boards, memory modules, enclosures, power supplies, or any other accessories or attached items).

4. Any item returned to MYLEX without a valid RMA number will be returned to the shipper.

Products shipped to MYLEX must be shipped or mailed at the shipper's risk, freight prepaid, to the address below.

Mylex Corporation
34551 Ardenwood Blvd.
Fremont, California U.S.A.
94555-3607

Mylex will pay for return freight via such carrier as MYLEX shall deem appropriate.

Technical Support

Technical support, to assist you in resolving problems with MYLEX products, is available through MYLEX's Technical Support Department. In the U.S.A., the Technical Support Department can be reached by telephone at (510) 608-2400, by FAX at (510) 745-7715, or by e-mail at support@mylex.com. Current hours of operation, which are subject to change, are from 6:00 a.m. to 6:00 p.m. Pacific Time, Mondays through Fridays, **excluding U.S.A. national holidays.** Many problems can also be solved using the Mylex Web site (http://www.mylex.com), which has a support area available 24 hours a day for interactive technical support.

Included with the shipment of most MYLEX products is a System Problem Report (SPR) form. When contacting the Technical Support Department for assistance with an installation or compatibility problem, we recommend that this form be completed and sent by facsimile or mail to MYLEX. Completion of this form will allow our Technical Support Department to solve most technical problems expeditiously.

Mylex will make reasonable efforts to address compatibility problems which may arise with respect to third party products, but shall not be responsible for the compatibility of its products with the products of any third party. Customers are advised to verify each product's compatibility with their installation before committing to any particular procurement plan.

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